

# **CalWater Experiment**

Marty Ralph

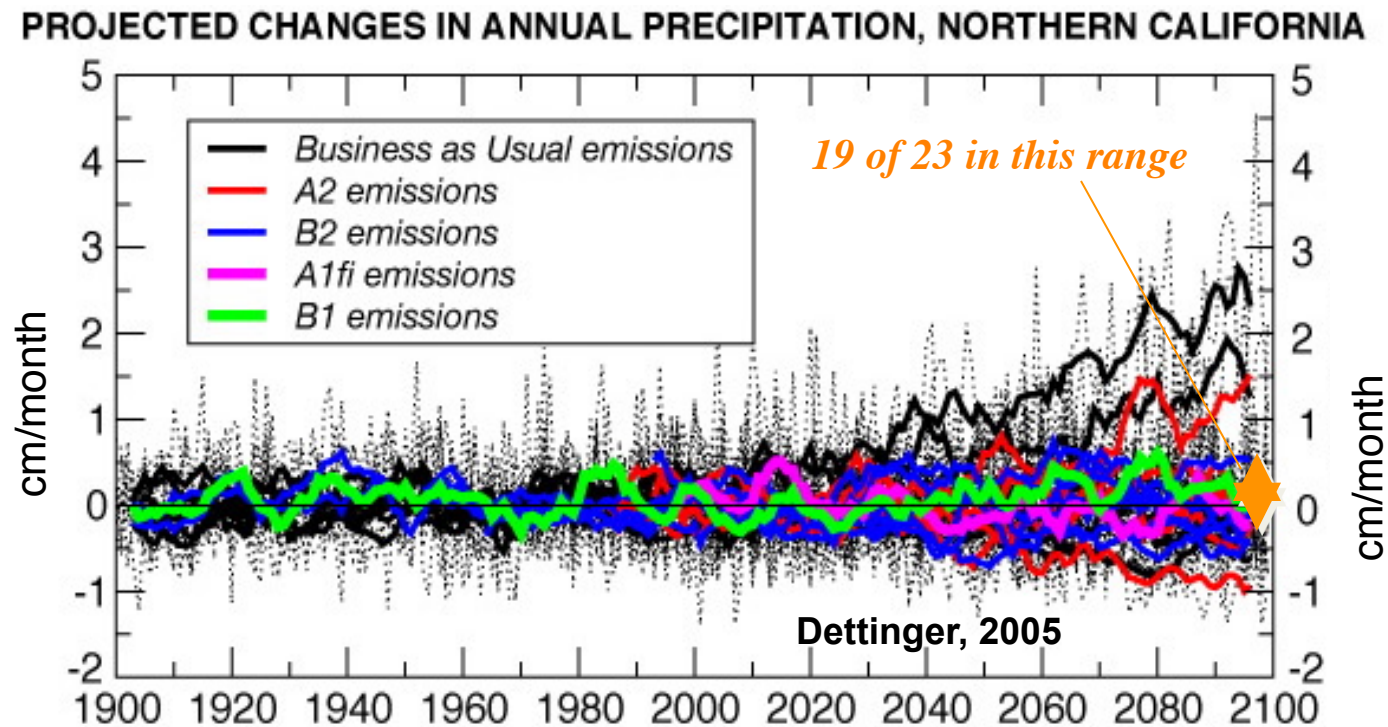
8 October 2010

HMT-West Annual meeting

Santa Rosa, CA

Projected trends:

## Precipitation



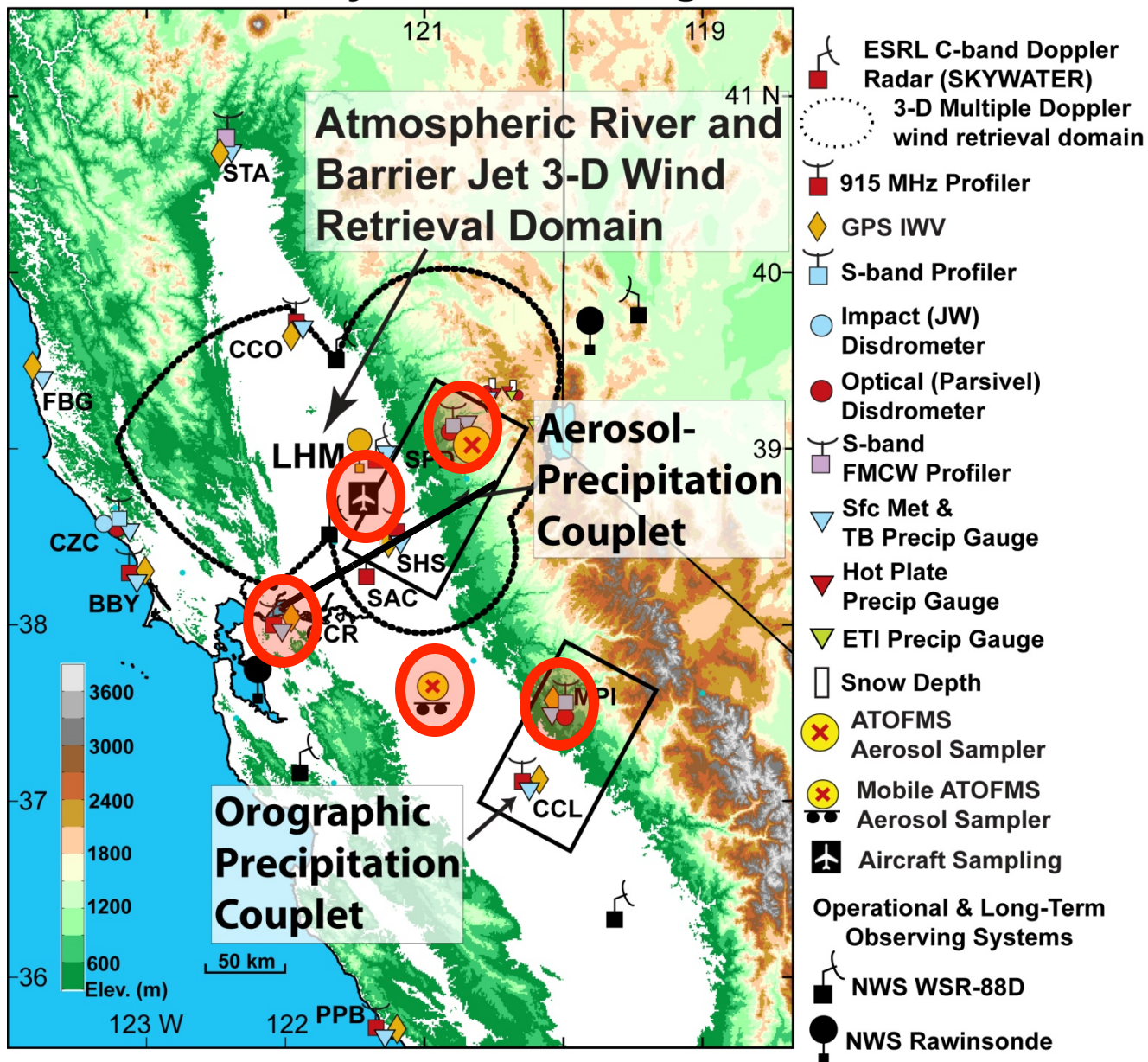
Most climate projections fall within a fairly narrow range of precipitation changes in much of the US. In Northern California, "small change" is most common projection.

- However, as with Arctic Pack Ice projections from IPCC, it is unclear that the current models capture the full range of uncertainty in annual precipitation and even with no change in annual totals, the extreme events (storms/droughts) are expected to increase

# Science themes

- How do aerosols (small solid or liquid particles in the air) affect the formation of clouds and precipitation, and what are the sources of the aerosols that act as seeds for the formation of droplets and/or ice. How might these effects change in a changing climate.
- How well are atmospheric rivers (ARs), and the major precipitation events associated with them, represented in global and regional simulation and forecast models. How well are ARs represented in climate models, and how might AR amplitudes, frequencies and locations vary in a changing climate.

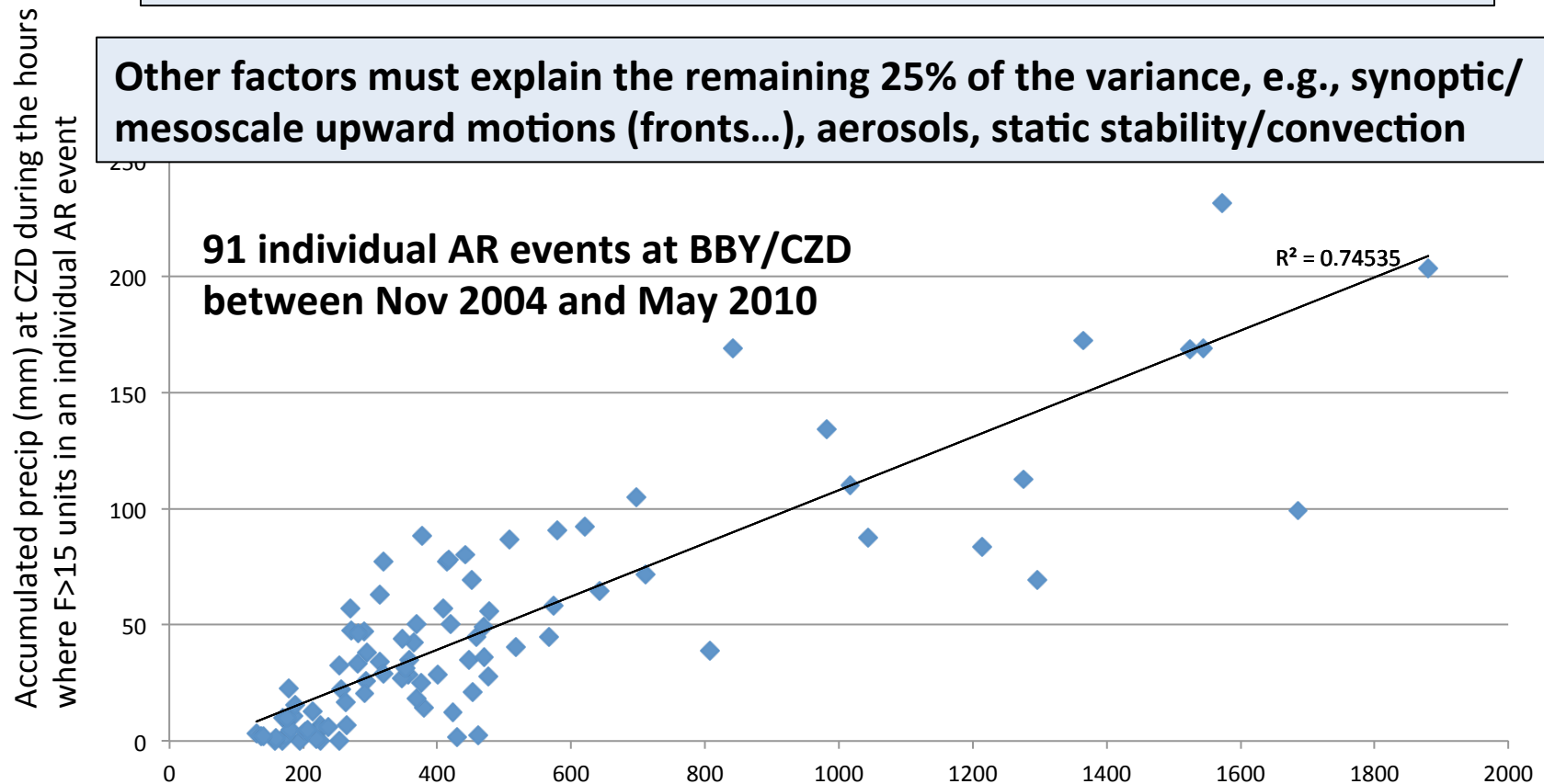
# CalWater and Key HMT Observing Sites - Winter 2011



Each data point is from a single storm and corresponds to the time-integrated upslope bulk flux and accumulated precipitation at CZD for the time during that event that F stayed continuously above 15 units.

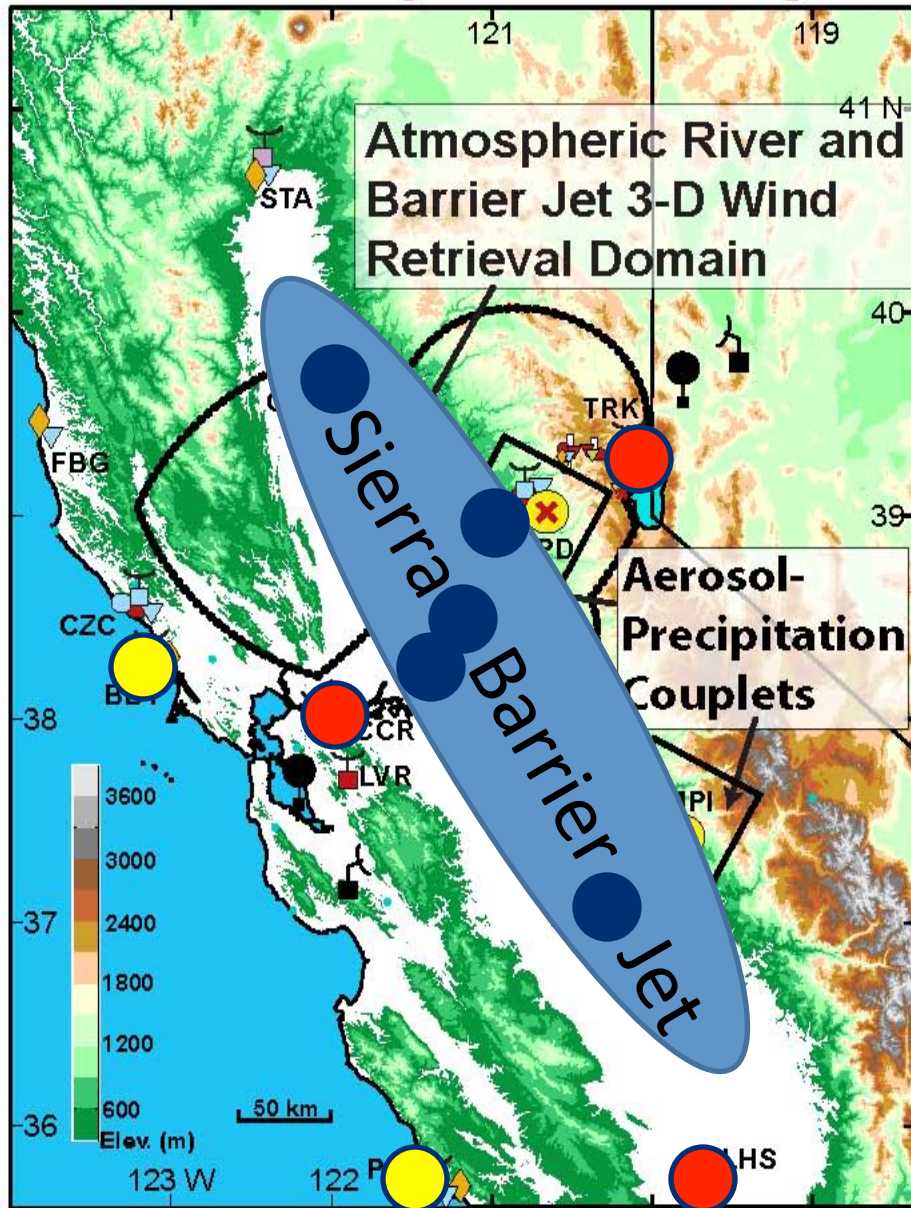
75% of the variance of “AR storm total” (i.e.,  $F > 15$  units and  $IWV > 2$  cm) precipitation at CZD is explained by variations in the time-integrated bulk upslope flux over the duration of the AR conditions with  $F > 15$  units.

**Other factors must explain the remaining 25% of the variance, e.g., synoptic/mesoscale upward motions (fronts...), aerosols, static stability/convection**





## CalWater and Key HMT Observing Sites - Winter 2009/10



- Coastal barrier jet
- Sierra barrier jet
- No barrier jet

## Lesson from CalWater 2010

- Profiler/ARO array documented coastal and Sierra barrier jets
- Key case was in late Feb
- NBB rain occurred much less in Southern Sierra S-Prof site than at Central Sierra S-Prof site

# Timelines for key manned field facilities

- 1 Dec 2010 – 15 Mar 2011
  - NOAA “Sky Water Radar”(forecast-based)
  - NOAA balloon sounding system (forecast based)
- 1 Feb – 7 Mar 2011
  - PNNL G-1 aircraft (70 science hours)
  - Scripps Mobile JRT
  - Scripps Sugar-Pine Dam ATOFMS

# PNNL G-1 in CalWater

Focus on aerosols and microphysics, including role of Sierra barrier Jet

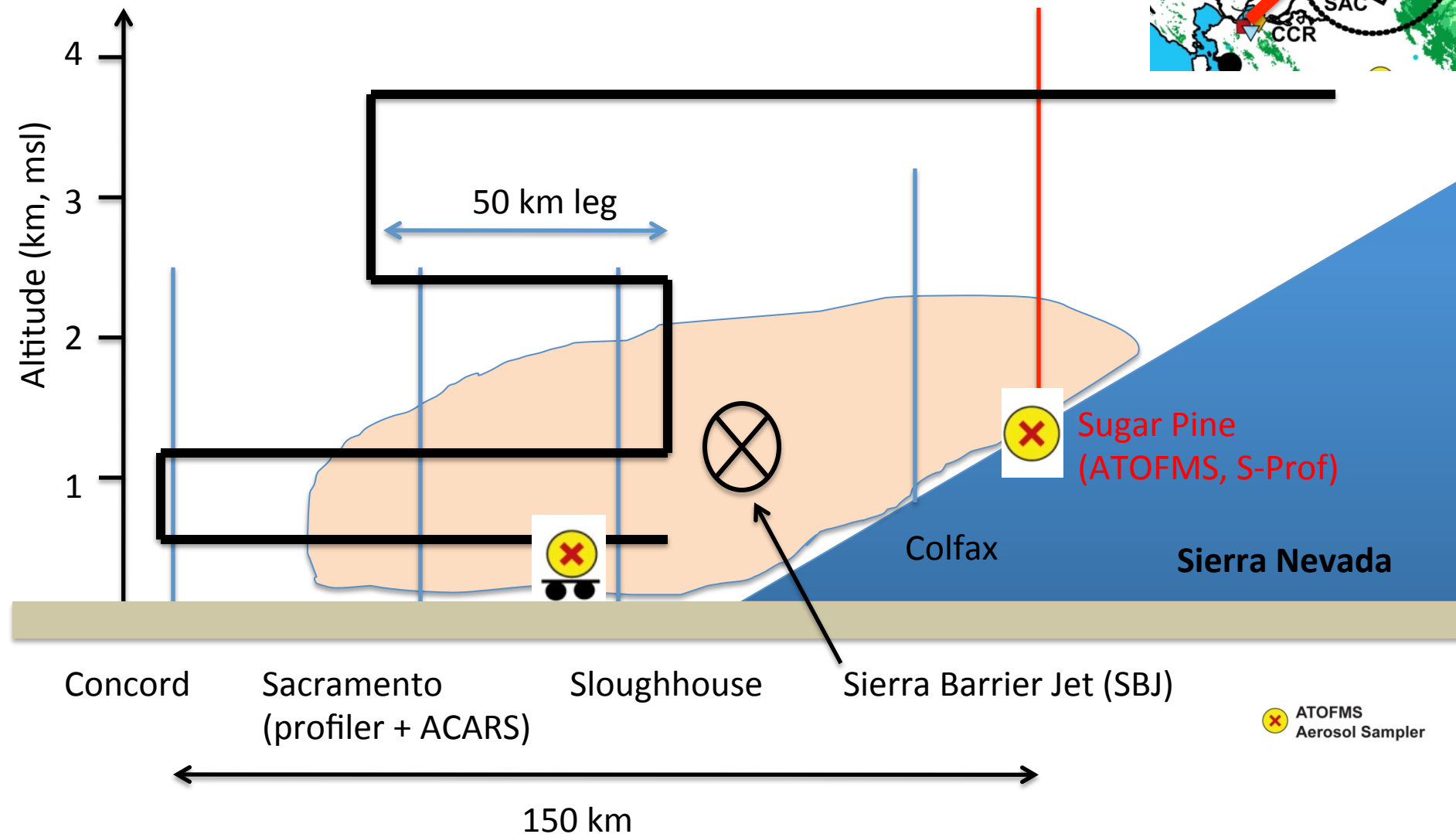
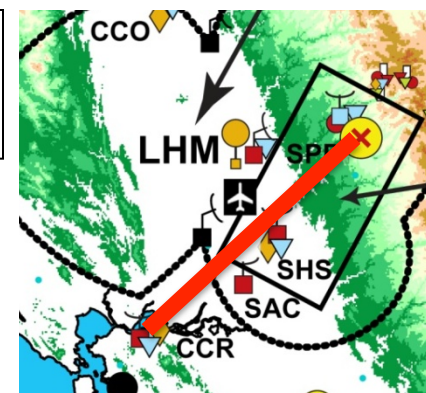


Beat Schmid, Technical Director



# Cross-SBJ G-1 flight profile (400 km; 1.3 h)

## Wind profiler observations can help select prior to flight



# CalWater Web Page

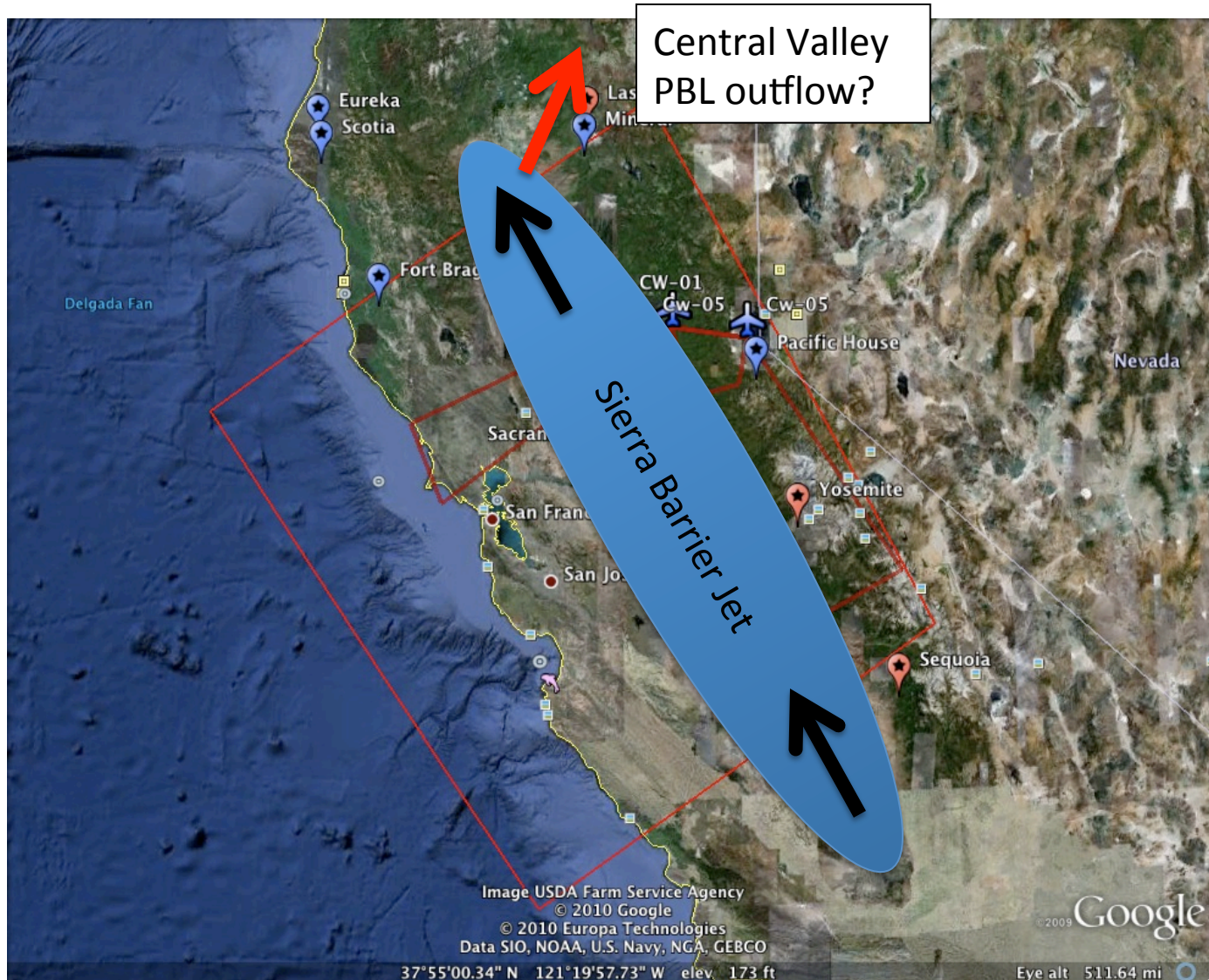
- <http://www.esrl.noaa.gov/psd/calwater/>

# Day 0: Precondition





# Day 1: SBJ+ Central valley outflow





# Day 2: Heavy precip with AR + SBJ

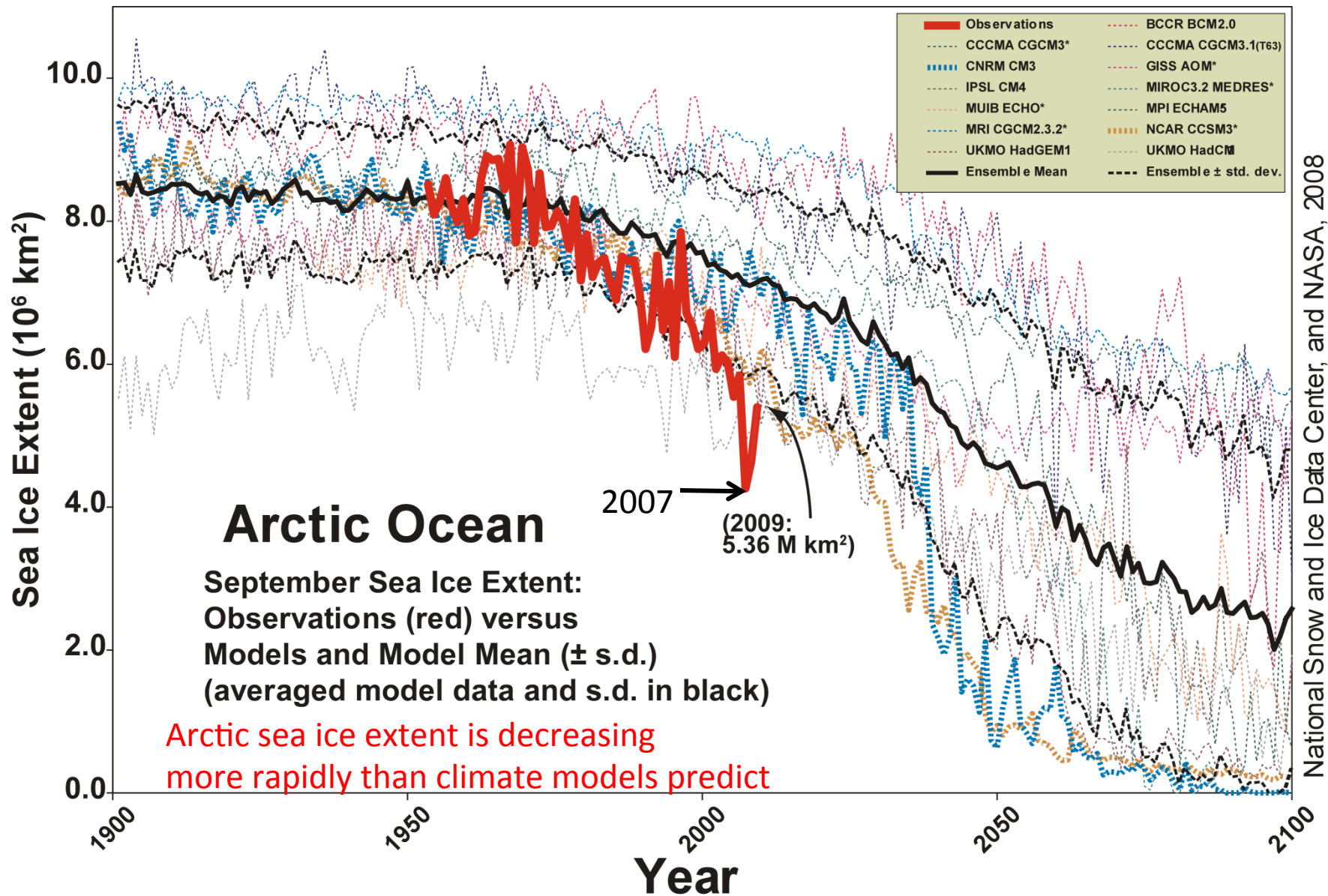




# Day 3: Post-frontal orographic precip



# Trend in September Arctic Sea Ice Extent



Courtesy J. Stroeve - personal communication